PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Yuzuru Suzuki et al.	:	
	:	Art Unit: To be assigned
Appl. No.: To be assigned	:	
Filed: May 22, 2001	:	Examiner: To be assigned
For: ELECROMAGNETIC ACTUATOR AND COMPOSITE ELECTROMAGNETIC ACTUATOR APPARATUS	:	Atty Docket: SUM-02201

CERTIFICATE OF EXPRESS MAILING

I hereby certify that the foregoing document is being deposited with the United States Postal Service as express mail, postage prepaid, in an envelope addressed to: Commissioner of Patents, Washington, DC 20231 on May 22, 2001.

Tracey A. Newell
Express Mail No.: EL506927595US

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination of the above-referenced application, Applicant requests entry of the amendments set forth herein.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those which may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required for consideration of this paper (including fees for net addition of claims) are authorized to be charged in two originally-executed copies of a New Application Transmittal Letter filed herewith.

Also attached herewith is a set of "clean" rewritten claims in accordance with 37 C.F.R. § 1.121.

Kindly enter the following amendments:

IN THE CLAIMS:

Please amend claims 4-6,9, and 11 as follows:

4. (Once Amended) An electromagnetic actuator according to Claim [1 or] 3, wherein

the stator yoke of the stationary assembly is a hollow cylinder, the two coils are ring-shaped and wound on the respective cylindrical bobbins;

the movable assembly has a supporting shaft at the center thereof, the movable yoke unit is located such that the movable yoke unit and the two coils effect electromagnetic action on each other; and

a pair of flanges are provided at both axial end surfaces of the stator yoke, each flange having a bearing mechanism, the supporting shaft is retained by the bearing mechanisms so as to be movable in the axial direction.

5. (Once Amended) An electromagnetic actuator according to [any one of Claims 1 to 4]Claim 4, wherein the movable magnet unit of the movable assembly is formed of at least one columnar of hollow magnet axially magnetized with two opposite polarities, namely, north pole and south pole, and the movable yoke unit is constituted by a pair of soft magnetic members that have a substantially identical configuration with each other and are disposed to sandwich the movable magnet unit and to abut respectively against a north-pole end surface and a south-pole surface thereof.

6. (Once Amended) An electromagnetic actuator according to [any one of Claims 1 to 4]Claim 4, wherein the movable yoke unit of the movable assembly is constructed by one or more columnar or hollow soft magnetic members, the movable magnet unit is constructed by a pair of magnets that have a substantially identical configuration with each other, are disposed to sandwich the movable yoke unit and to abut against both axial end surfaces thereof and are magnetized so that the inward portion and the outward portion of one magnet are polarized oppositely from each other and that the outward portion of one magnet is polarized oppositely from the outward portion of the magnet.

9. (Once Amended) An electromagnetic actuator according to Claim [7 or] 8, wherein the travel distance of the movable assembly in the axial direction is set to 1.0 mm or less.

11. (Once Amended) A composite electromagnetic apparatus which comprises:

[an electromagnetic actuator according to any one of Claims 1 to 9;]

a stationary assembly that includes two coils disposed coaxially with each other inside a hollow stator yoke composed of a soft magnetic material;

a movable assembly, disposed on a rotating shaft, that includes a movable magnet unit and movable yoke unit both disposed inside the coils with a very small clearance therefrom so as to be movable in the axial direction, wherein the movable assembly travels in the axial direction by the interaction between a magnetic field generated by the movable magnet unit and a current passing through the coils

a stepping motor disposed on the [same] rotating shaft [as the electromagnetic actuator]; and

a converting mechanism for converting the rotational motion of the rotating shaft by the stepping motor into a linear motion, and in which

the [electromagnetic actuator causes]stationary assembly and the movable assembly cause the rotating shaft to move linearly,

wherein rough adjustment by the stepping motor is performed in an open loop, while fine adjustment by the electromagnetic actuator is performed in a closed loop.

Please add new claims 15-20 as follows:

15. An electromagnetic actuator according to Claim 1, wherein

the stator yoke of the stationary assembly is a hollow cylinder, the two coils are ring-shaped and wound on the respective cylindrical bobbins;

the movable assembly has a supporting shaft at the center thereof, the movable yoke unit is located such that the movable yoke unit and the two coils effect electromagnetic action on each other; and

a pair of flanges are provided at both axial end surfaces of the stator yoke, each flange having a bearing mechanism, the supporting shaft is retained by the bearing mechanisms so as to be movable in the axial direction.

16. An electromagnetic actuator according to Claim 1, wherein the movable magnet unit of the movable assembly is formed of at least one columnar of hollow magnet axially magnetized with two opposite polarities, namely, north pole and south pole, and the movable yoke unit is constituted by a pair of soft magnetic members that have a substantially identical configuration with each other and are disposed to sandwich the movable magnet unit and to abut respectively against a north-pole end surface and a south-pole surface thereof.

17. An electromagnetic actuator according to Claim 16, wherein the outer diameter of the movable magnet unit of the movable assembly is set to be smaller than the outer diameter of the movable yoke unit.

18. An electromagnetic actuator according to Claim 1, wherein the movable yoke unit of the movable assembly is constructed by one or more columnar or hollow soft magnetic members, the movable magnet unit is constructed by a pair of magnets that have a substantially identical configuration with each other, are disposed to sandwich the movable yoke unit and to abut against both axial end surfaces thereof and are magnetized so that the inward portion and the outward portion of one magnet are polarized oppositely from each other and that the outward portion of one magnet is polarized oppositely from the outward portion of the magnet.

19. An electromagnetic actuator according to Claim 18, wherein the outer diameter of the movable yoke unit of the movable assembly is set to be smaller than the outer diameter of the movable magnet unit.

20. An electromagnetic actuator according to Claim 18, wherein the travel distance of the movable assembly in the axial direction is set to 1.0 mm or less.

REMARKS

Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-951-6676.

Respectfully submitted,
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Date: May 22, 2001

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Clean Copy of Claims as Amended herein

4. An electromagnetic actuator according to Claim 3, wherein

the stator yoke of the stationary assembly is a hollow cylinder, the two coils are ring-shaped and wound on the respective cylindrical bobbins;

the movable assembly has a supporting shaft at the center thereof, the movable yoke unit is located such that the movable yoke unit and the two coils effect electromagnetic action on each other; and

a pair of flanges are provided at both axial end surfaces of the stator yoke, each flange having a bearing mechanism, the supporting shaft is retained by the bearing mechanisms so as to be movable in the axial direction.

5. An electromagnetic actuator according to Claim 4, wherein the movable magnet unit of the movable assembly is formed of at least one columnar of hollow magnet axially magnetized with two opposite polarities, namely, north pole and south pole, and the movable yoke unit is constituted by a pair of soft magnetic members that have a substantially identical configuration with each other and are disposed to sandwich the movable magnet unit and to abut respectively against a north-pole end surface and a south-pole surface thereof.

6. An electromagnetic actuator according to Claim 4, wherein the movable yoke unit of the movable assembly is constructed by one or more columnar or hollow soft magnetic members, the movable magnet unit is constructed by a pair of magnets that have a substantially identical configuration with each other, are disposed to sandwich the movable yoke unit and to abut against both axial end surfaces thereof and are magnetized so that the inward portion and the outward portion of one magnet are polarized oppositely from each other and that the outward portion of one magnet is polarized oppositely from the outward portion of the magnet.

9. An electromagnetic actuator according to Claim 8, wherein the travel distance of the movable assembly in the axial direction is set to 1.0 mm or less.

11. A composite electromagnetic apparatus which comprises:

a stationary assembly that includes two coils disposed coaxially with each other inside a hollow stator yoke composed of a soft magnetic material;

a movable assembly, disposed on a rotating shaft, that includes a movable magnet unit and movable yoke unit both disposed inside the coils with a very small clearance therefrom so as to be movable in the axial direction, wherein the movable assembly travels in the axial direction by the interaction between a magnetic field generated by the movable magnet unit and a current passing through the coils

a stepping motor disposed on the rotating shaft; and

a converting mechanism for converting the rotational motion of the rotating shaft by the stepping motor into a linear motion, and in which

the stationary assembly and the movable assembly cause the rotating shaft to move linearly,

wherein rough adjustment by the stepping motor is performed in an open loop, while fine adjustment by the electromagnetic actuator is performed in a closed loop.